Printed Page:-05 **Subject Code:- AEC0303**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B. Tech

SEM: IV - THEORY EXAMINATION (2024 - 2025)

Subject: Signal, System and Network

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. Which of the following system is causal system? [y(t) is output and u(t) is a input step function] (CO1, K2) 1

(a) y(t) = sin(u(t+3))

(b) y(t) = 5 u(t) +3u(t-1)

(c) y(t) = 5u(t) +3 u(t+1)

(d) y(t) = sin(u(t+3)) + sin(u(t-3))

1-b. The average power of an energy signal is _____(CO1, K1) 1

(a) 0

(b) 1

(c) infinite

(d) none of these

1-c. The output signal in an LTI system with known input and known _____.(CO2, K2) 1

(a) impulse response can always be determined.

(b) impulse response cannot always be determined.

(c) impulse response can and cannot be determined.

(d) None of these

1-d. Convolution of a finite sequence with an infinite sequence (CO2, K3) 1

(a) may be a finite or infinite sequence

.

(b) is always a finite sequence

(c) is always an infinite sequence

(d) cannot be found

1-e. The Laplace transform of u(t − 2) is (CO3, K3) 1

(a) $\frac{1}{s+2}$

(b) $\frac{1}{s-2}$

(c) $\frac{e^{2s}}{s}$

(d) $\frac{e^{-2s}}{s}$

1-f. In an electric circuit, the dual of resistance is (CO3, K1) 1

(a) conductance

(b) inductance

(c) capacitance

(d) open circuit

1-g. In two-port networks the parameter g12 is called _____(CO4, K1) 1

(a) Short circuit input impedance

(b) Short circuit current gain

(c) Open circuit reverse voltage gain

(d) Open circuit output admittance

1-h. For the given information Z11 = 4, Z12 = 1, Z21 = 1, Z22 = 2. Find the value of Y11. (CO4, K3) 1

(a) 2/7

(b) 3/7

(c) 4/7

(d) 5/7

1-i. If the ratio of the polynomial P (s) and its derivative gives a continued fraction expansion with _____ coefficients, then the polynomial P (s) is Hurwitz. (CO5, K2) 1

(a) all negative

(b) all positive

(c) positive or negative

(d) positive and negative

1-j. The poles of a stable should lie in (CO5, K1) 1

(a) Left half of the s-plane including jw axis.

(b) Right half of the s-plane including jw axis

(c) anywhere in s plane

.

(d) only on positive real axis.

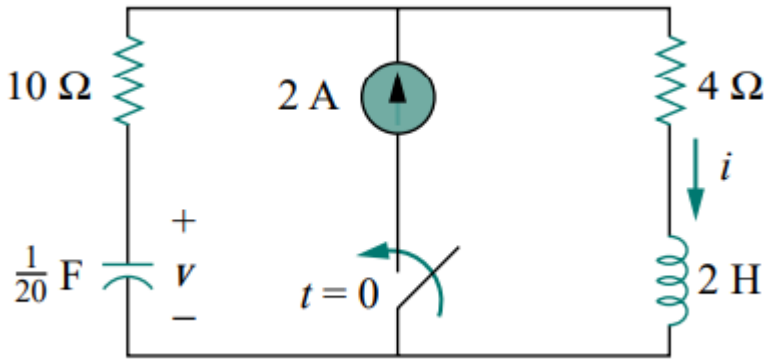
2. Attempt all parts:-

2.a.	Define Homogeneity and Additivity Properties of a linear system.(CO1, K1)	2
2.b.	Define Phase delay and group delay of an LTI system.(CO2, K1)	2
2.c.	What do you mean by region of covergence of laplace tranformation. (CO3, K2)	2
2.d.	Draw the equivalent circuit of Y parameter.(CO4, K3)	2
2.e.	Write down the properties of immitance function. (CO5, K1)	2

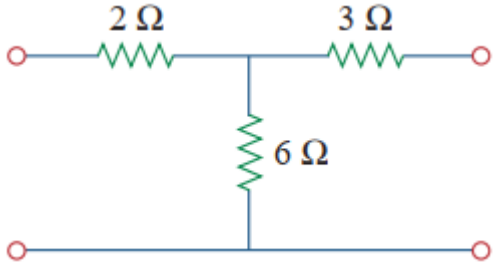
SECTION-B 30

3. Answer any five of the following:-

3-a.	check whether the following discrete time systems are linear or non-linear. (CO1, K4) (i) $y(n) = x(n^2)$ (ii) $y(n) = x^2(n)$	6
3-b.	Describe Energy Signal. Find the energy of (CO1, K3) $x(t) = 4\,[u(t+3) - u(t-5)]$	6
3-c.	State and prove the linear and Shifting property of FT . (CO2, K5)	6
3-d.	Determine and sketch the convolution of the following two signals: (CO2, K3) x(t) = u(t) and h(t) = δ(t)	6
3.e.	Determine v and i for t > 0 in the circuit of Figure. (CO3, K3)	6



3.f.	Find the ABCD parameters for the two-port network of Fig. (CO4, K3)	6



3.g.	Write down the Properties of RC Driving Point Impedance Function.(CO5, K1)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Determine whether the following systems are causal and invertible? (CO1, K4)	10

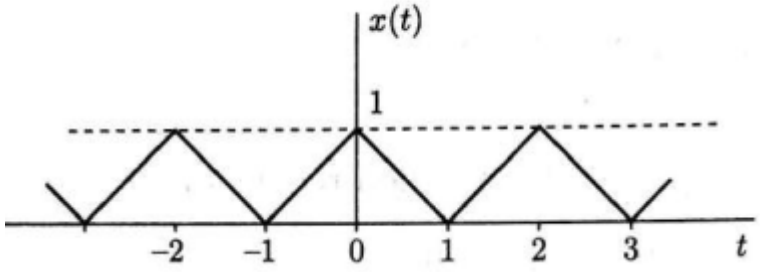
(i) $y(t) = 10\,x(t)$
(ii) $y(t) = x^2(t)$
(iii) $y(t) = \sum_{k=-\infty}^{n} x(k)$

4-b. Define periodic and aperiodic function. Also find x[n] is periodic or not if periodic find its time period. (CO1,.K4) 10

$x[n] = \sum_{-\infty}^{\infty} (\delta[n-4k] - \delta[n-1-4k])$

5. Answer any <u>one</u> of the following:-

5-a. Determine the triangular Fourier series for the triangular wave shown in figure and plot the line spectrum. (CO2, K4) 10



5-b. Describe Fourier transform. Find the Fourier transform G(w) of the signal g(t) = $\frac{1}{1+t^2}$ (CO2, K3) 10

6. Answer any <u>one</u> of the following:-

6-a. Obtain the Laplace transform of each of the following functions: (CO3, K3) 10

(a) $e^{-2t}\cos 3tu(t)$ (b) $e^{-2t}\sin 4tu(t)$

(c) $e^{-3t}\cosh 2tu(t)$ (d) $e^{-4t}\sinh tu(t)$

6-b. Define Impulse response.A system is formed by cascading two systems as shown in Figure. Given that the impulse response of the systems are (CO3, K3) 10

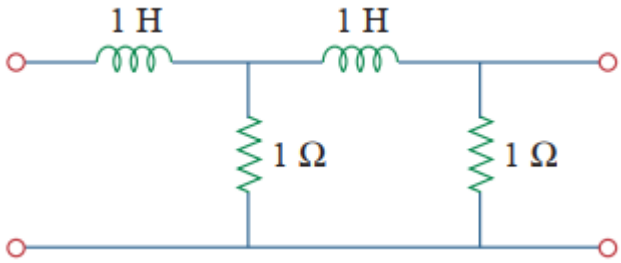
$h_1(t) = 3e^{-t}u(t)$,

$h_2(t) = e^{-4t}u(t)$

(a) Obtain the impulse response of the overall system.
(b) Check if the overall system is stable.

7. Answer any <u>one</u> of the following:-

7-a. Write the Reciprocity condition in Y and H Parameters.For the ladder network in Fig, determine the Y parameters in the s domain.(CO4, K5) 10

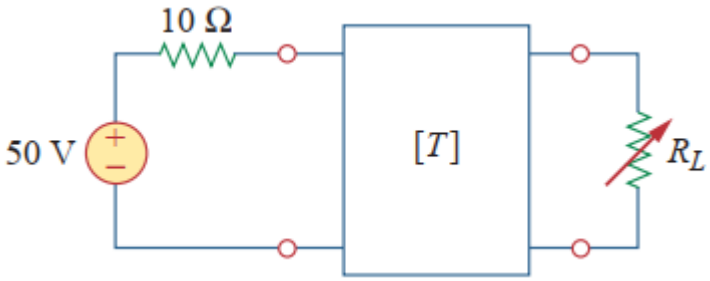


7-b. Write the general equation of ABCD parameters and its relation with Z parameters. (CO4, K5) 10

The ABCD parameters of the two-port network in Fig. are

$$\begin{bmatrix} 4 & 20\ \Omega \\ 0.1\ \text{S} & 2 \end{bmatrix}$$

The output port is connected to a variable load for maximum power transfer. Find and the maximum power transferred.



8. Answer any <u>one</u> of the following:-

8-a. Describe the Cauer first and second form.The driving point impedance of an LC network is given by 10

$$Z(s) = \frac{2s^5 + 12s^3 + 16s}{s^4 + 4s^2 + 3}$$

Determine the Cauer - first form of the network (CO5, K6)

8-b. Define realization theory and properties of Hurwitz polynomial .Also check the given polynomial is Hurwitz or not (CO5, K4) 10

$P(s) = 5\,s^4 + 3s^2 + 2$